PIER Electricity Energy Storage Program
Rationale & Overview

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Electrical Storage Program

Public Interest Energy Research (PIER)

Overview

- PIER Electrical Energy Storage Program
- Rationale for Electrical Energy Storage Program
- Current Status of the Program

History of Energy Commission Funding of Electricity Energy Storage Technologies.

- Commission has been exploring electricity energy storage (EES) since 1990.
- Commission funded RD&D for compressed air energy storage, flywheels, capacitors and modular pumped hydro till year 2002.
- Most of the work was on feasibility and component development.

PIER ELECTRICITY ENERGY STORAGE INITIATIVE

- In 2002, PIER initiated an EES program, in cooperation with US DOE that cuts across all the PIER segments.
- The program builds upon the component level and system RD&D already completed by the US DOE and other organizations.
- PIER goal is to test & demonstrate seamless integration of emerging EES technologies in the California electricity system.

Program Background

Recent Trends….

- **California has had problems with electric supply, reliability and price spikes in recent years.**

- **California energy crisis brought forth an appreciation for reliability, load management, demand reduction and energy efficiency – and a willingness to pay for it by some customers.**

Promising Developments in Storage Technologies

- Rapid evolution in electricity storage technologies with desirable attributes make them viable options to solve California's electrical system problems.
- A few technologies have advanced to the pre-commercialization stage.
- Encouraging demonstration by the US DOE, utilities and other organizations.
- Development in power conversion, control & communications technologies for integration with user's energy systems & the grid.

SPECIFIC PROBLEMS SEEKING SOLUTIONS

Renewable Resources

- 1800 MW of underutilized wind power.
- Mandate for 20% Renewable use by 2017.

Transmission & Distribution Congestion

- Transmission bottleneck joining CA north & south
- San Francisco transmission bottleneck

SPECIFIC PROBLEMS SEEKING SOLUTIONS

System Reliability

- Events such as in 1996 & 2003 grid collapse causing blackouts require immunity
- Ancillary Services for reserve margins, frequency control, reactive power etc are getting expensive.

Distributed Generation Proliferation

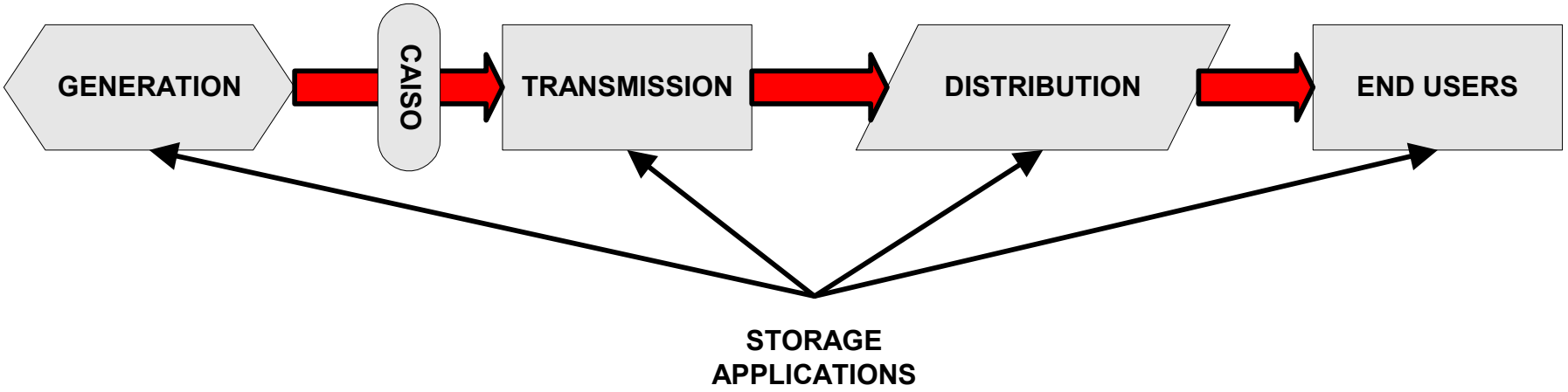
- Provide load following capability.
- Seamless transition to back-up power

SPECIFIC PROBLEMS SEEKING SOLUTIONS

Industrial & Commercial Customers

- Required to shed loads at short notice
- Want to reduce peak demand charges
- Want pollution free back-up power
- Put premium on reliability & power quality.

Storage Applications Throughout the California Electrical System



Electrical Energy Storage Program Goal

Seek viable options for electricity problems through ***demonstration of electric energy storage*** *as a technically sound,* ***cost-effective*** *and* ***broadly applicable*** *solution for reliable electricity system capacity and for electric energy management in California.*

Seeking a Solution with Value, Not Another Technology Demonstration

- **Move beyond a technical demonstration.**
- **Demonstrate integration with the grid, user need and an economic viability.**
- **Facilitate the transition of a demonstrated, emerging technologies emerging to the next phase.**

Defined & Established Value for California EES Applications

- DOE & California Energy Commission (CEC) sponsored studies to assess the value of selected applications.
- Analysis focused on use of storage for selected applications with discernable benefits and Markets
- Calculated the price goals EES applications have to meet for California specific needs.

Overview of Valuation Process

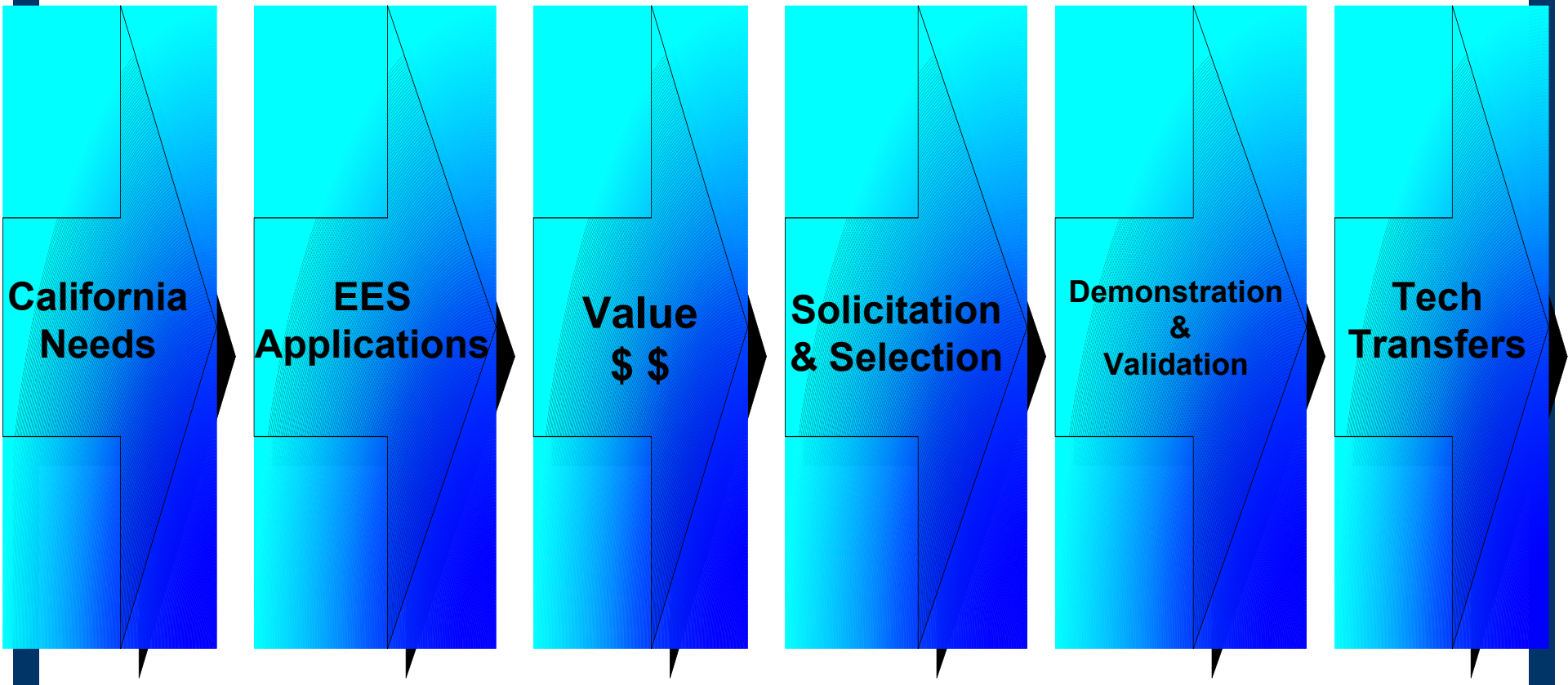
Electric Energy Storage Benefits, Value and Markets

- Selected suitable utility, customer and renewable applications.
- Matched potential storage opportunities with California system problems.
- Calculated monetary value of benefits($/kW value, MW saved, site specific and state-wide benefits).
- Developed Market Potential Estimates.

Applications

- **Bulk Electricity Price Arbitrage**
- **Utility T & D Deferral**
- **Customer Time-of-Use Cost Savings**
- **Customer Demand Charge Cost Savings**
- **Customer Premium Power**
- **Onsite Generation Time-Shift (Off-Peak to On-Peak)**
- **Renewables Capacity Firming**
- **Renewables Contractual Time-of-production Payments**

Program Process



PROGRAM STATUS TO DATE

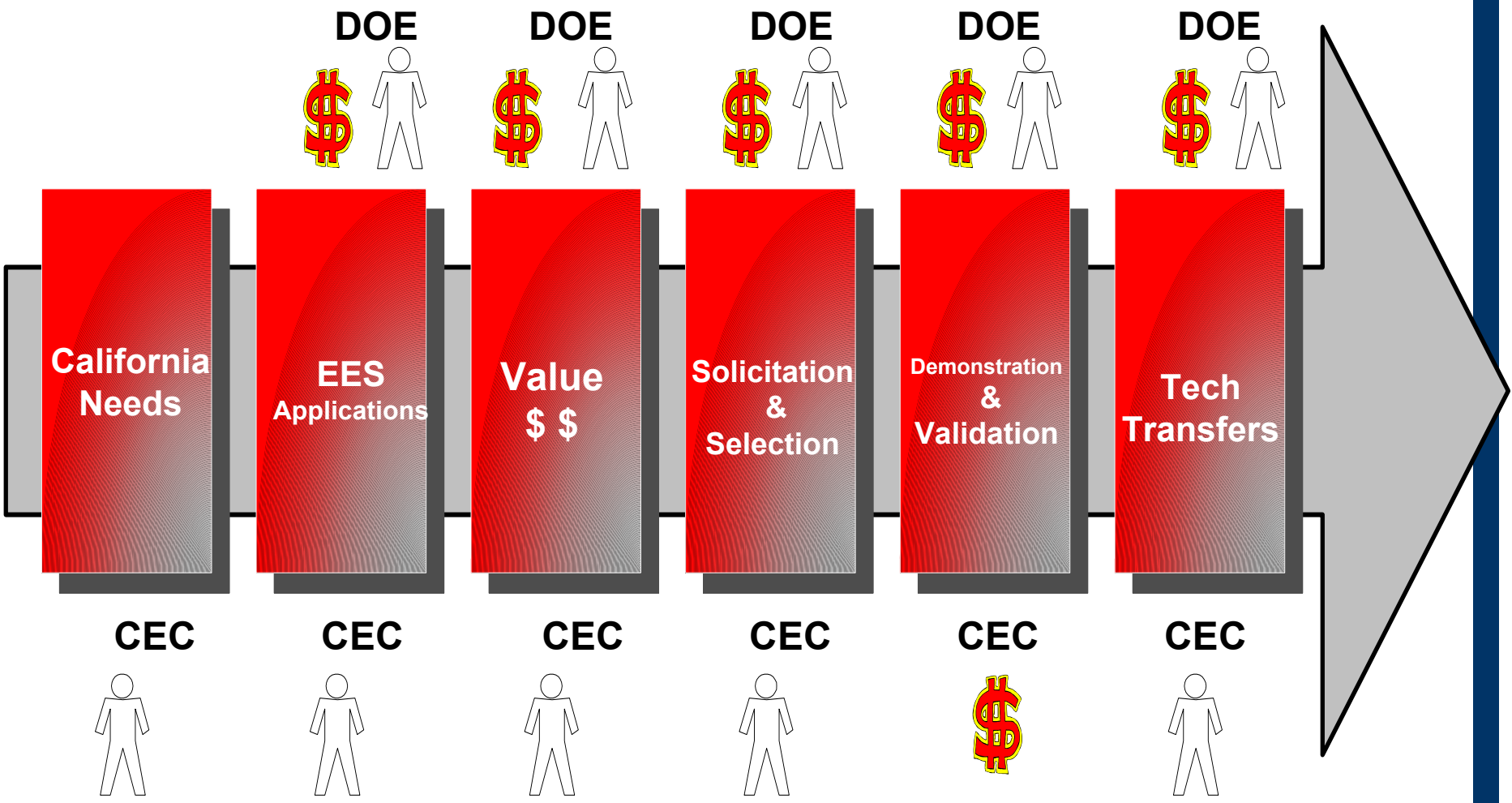
- RFP issued for $ 5 million. 4 projects funded.

  1 was cancelled after the contracting company was acquired by another company.

- Selection based on use of storage for applications with discernable, tangible benefits to utilities, Cal-ISO and end-user.

- Sandia National Laboratory monitoring the performance with funding from the US DOE.

CEC/DOE Partnership



PIER Electrical Energy Storage Program Team

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- **Renewable Energy (Wind)**
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